

A taxonomic review of the Green-fronted Hummingbird

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The Green-fronted Hummingbird *Amazilia viridifrons* is endemic to southern Mexico in the states of Guerrero, Oaxaca and Chiapas. Among Mexican and Central American hummingbirds, the combination of its bright white underparts and bright red, black-tipped bill is shared only by the Violet-crowned Hummingbird *A. violiceps* of northwestern and central Mexico. Like several other Mexican hummingbirds, the taxonomy and distribution of *viridifrons* has been confused in the literature.

Distributional and taxonomic history

Friedmann *et al.* (1950) defined the range of *A. viridifrons* as "Central Oaxaca and central Guerrero south to Chiapas". At the same time, those authors and the A.O.U. (1957) reported the range of the closely related *A. violiceps* as extending south to Chiapas. Phillips (1964), however, in providing the first clear account of the ranges and historical taxonomy of *viridifrons* and *violiceps*, considered records of *violiceps* from southern Oaxaca and Chiapas equivocal, a conclusion followed tentatively by Binford (1989) and apparently accepted (without comment) by A.O.U. (1983) who defined the range of *violiceps* as "south to Oaxaca, Puebla and Hidalgo". My field and museum investigations have also revealed no viable evidence that *violiceps* occurs farther south than Guerrero and northwestern Oaxaca.

Most authors (e.g. A.O.U. 1983, Binford 1989, Friedmann *et al.* 1950) have treated *viridifrons* as a species. Phillips (1964), however, considered *viridifrons* as a subspecies of *violiceps*. He pointed out that the two forms were not known to breed sympatrically, and that the overlap in their ranges might be due to unknown movements of *A. violiceps*.

In life the two forms are quite distinct, and their call notes are readily distinguishable: *violiceps* gives hard strong chips and chatters reminiscent of Cinnamon Hummingbird *A. rutila*, while *viridifrons* gives distinctly different, soft dry chips and chatters suggesting Broad-billed Hummingbird *Cynanthus latirostris*. In addition, *A. v. violiceps*, the southern subspecies of Violet-crowned Hummingbird, is not known to be migratory, although local wandering probably occurs, e.g. all Oaxaca records to date are between July and October (Binford 1989). While both forms may occur at the same locations in Guerrero, at least seasonally, they favour different habitats there: *violiceps* occurs mainly in tropical arid thorn scrub of the Rio Balsas drainage, while *viridifrons* occurs mainly in more temperate arid oak scrub (pers. obs.). In view of these facts, and that the two forms are visually quite distinct,

with no hybrids known, I also consider *viridifrons* and *violiceps* as separate species.

Friedman *et al.* (1950) considered *viridifrons* monotypic. Following explorations in previously unknown areas of southern Oaxaca in the 1960s, Phillips (1964) described the distinctive subspecies *A. violiceps* (= *viridifrons*) *wagneri*, characterized as "redder on the wing, sides, flanks, sides of crissum and a line bordering the white up to the face and extending narrowly to the bill. Also [redder] on the tail and edges of the upper tail-coverts" (translated here from the Spanish). He considered birds from interior Oaxaca (Totolapan to the vicinity of Nejapa) as intermediate between nominate *viridifrons* and *wagneri*.

Binford (1989) most recently discussed *viridifrons* and pointed out that "*wagneri* . . . apparently separates two identical populations of *A. v. viridifrons*". He suggested the possibility that *wagneri* might be specifically distinct "if the extreme amount of variation in the intensity and extent of rusty coloration in *wagneri* can be accounted for by age and sex rather than geography". It should be noted that Binford (1989) treated all birds from Totolapan to Nejapa as *wagneri* (based mostly on their conspicuously cinnamon flanks rather than a full consideration of all *wagneri* characters), although he recognized that many appeared intermediate between *wagneri* and *viridifrons* (L. C. Binford pers. comm.).

Here I review the taxonomy of *A. viridifrons* and describe a new subspecies of it from central Oaxaca.

Methods and results

I examined 113 specimens of *A. viridifrons*, 110 of which were assembled for direct comparison at the California Academy of Sciences; these represent virtually all specimens of *viridifrons* in North American collections. In addition, between 1983 and 1992 I travelled throughout the range of the Green-fronted Hummingbird and gained extensive field experience with it at numerous points between southern Guerrero and western Chiapas.

When specimens were arranged by geography, sex, and age, four groupings became apparent: (1) Guerrero and western Oaxaca; (2) central Oaxaca; (3) southern Oaxaca and western Isthmus of Tehuantepec; and (4) eastern Oaxaca and Chiapas. However, as Binford (1989) pointed out, birds from Guerrero and western Oaxaca are essentially identical to birds from eastern Oaxaca and Chiapas. Figure 1 shows the distribution in the state of Oaxaca of the three forms described below.

Sex and to a lesser extent age were determined by the collectors' labels (apparently almost all correct) supported, for sex, by bill length (longer in females) and crown colour (typically darker in males, as first noted by Phillips 1964). Juveniles were identified by bill grooving, a mostly blackish upper mandible, rusty tips to crown and upperpart feathers, and distinct pale cinnamon tips to outer rectrices. Immatures (birds lacking bill grooving and often showing signs of first prebasic moult) often could be identified by unworn and/or retained pale

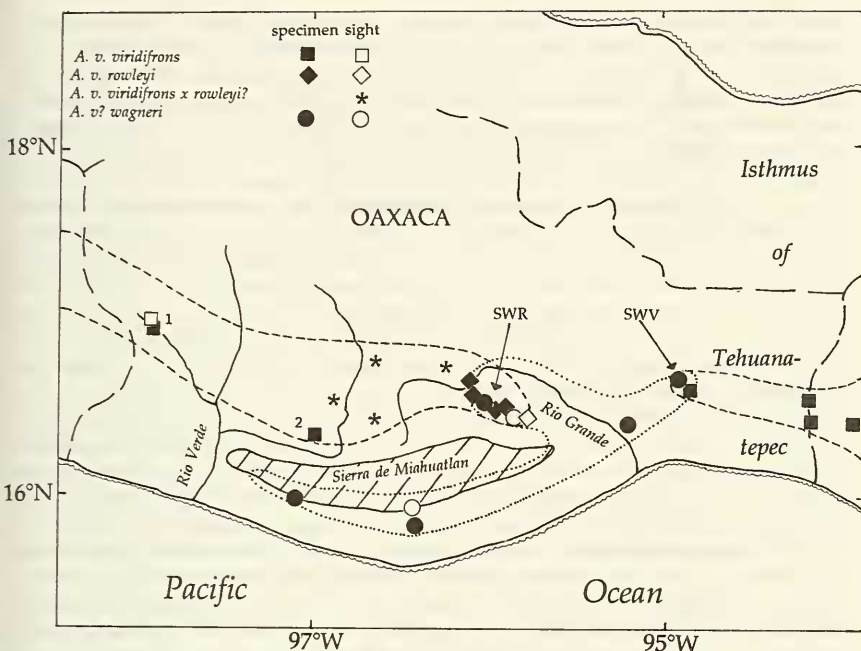


Figure 1. Distribution of Green-fronted Hummingbirds in the state of Oaxaca. Dotted line indicates the range of *wagneri*, dashed line indicates the ranges of nominate *viridifrons* and *rowleyi*. 1=Putla de Guerrero, 2=km 136. SWR: sympatry of *rowleyi* and *wagneri* (vicinity of Tototalpan SE to Nejapa and El Camaron). SWV: sympatry of nominate *viridifrons* and *wagneri* (12 miles NE of Juchitán).

cinnamon tips to their upperparts and in particular by pale tips to their outer rectrices.

Colour charts do not treat metallic or iridescent colours, and colour descriptions in the following accounts are my own interpretations. Most of the colours should be self-evident, e.g. copper being redder than bronze, cinnamon being redder than vinaceous, etc. Purplish-copper indicates copper tinged with purple, etc.

The characters of the birds from these four areas (comprising three forms) are as follows, including available data on nesting periods derived from Binford (1989), Rowley (1966, 1984), juvenile specimens, and personal observations. Immatures examined include juveniles, but juveniles were excluded from culmen measurements (culmen range given in mm; followed by mean length).

Amazilia viridifrons viridifrons (Elliot)

Cyanomyia viridifrons Elliot, 1871, *Ann. & Mag. Nat. Hist.* (4) 8: 267. "Putla, Mexico"=Putla de Guerrero, Oaxaca.

Diagnosis. **Western population** (see range, below). *Upperparts.* Crown blackish with oily green to bluish-green sheen in ♂; dark green

in ♀ and immature ♂. Nape, mantle, and chest sides bright, deep, emerald green; lower back to upper tail-coverts dull bronzy to grey-brown. *Underparts*. Flanks mottled bronzy-green on a dusky to dusky-vinaceous wash, often with pale cinnamon spots on hind flanks; vinaceous in flanks strongest in 2 ♂♂ (WVZ 21492, 21537) from km 136 on the Puerto Escondido Road. Axillars dusky or, in 4 of 6 ♂♂ from Puerto Escondido Road, mixed with pale cinnamon. Under tail-coverts may have faint dusky pale cinnamon spots on basal coverts and, less often, faint pale cinnamon shaft streaks on distal coverts. *Wings*. Secondaries lack any cinnamon at bases. Marginal wing-coverts cinnamon to pale cinnamon in ♂, dull pale cinnamon in ♀. *Tail*. ♂: burnished copper to purplish-copper with narrow bronzy-green edgings. Immature ♂: mostly deep purplish with narrow pale cinnamon tips to outer rectrices. ♀: bronzy to greenish-gold, with little or no burnished copper or purple.

Eastern population. Very much like western birds but ♀♀ and immatures often have the crown darker (very dark green), five such individuals showing a slight oily blue-green sheen to the crown; the flanks and axillars tend to be more extensively whitish with less bronzy-green spotting and little or no vinaceous wash; tails of ♂♂ and ♀♀ are frequently similar to one another (i.e. ♂♂ having less purple and ♀♀ more copper than western birds); and the bills may average longer. Due to a larger sample size than the western population, some characters of eastern birds are given here. *Underparts*. Flanks and axillars: in ♂, mostly whitish with some bronzy-green spotting and usually a slight dusky vinaceous wash (most pronounced on rear flanks where may become pale vinaceous-cinnamon spots); immature ♂ similar but with a stronger vinaceous-cinnamon wash and less bronzy-green spotting; ♀ similar to ♂ but averages more whitish with little or no dusky cinnamon wash; immature ♀ similar to ♀ but with stronger dusky cinnamon wash. Under tail-coverts usually clean white but rarely (2♀♀ from Chiapas) with faint pale cinnamon spots on basal coverts. *Tail*. ♂: bronzy-copper to (rarely) purplish-copper with narrow bronzy-green edgings (sometimes indistinct). Immature ♂: purplish-copper (2 birds) to bronzy (3 birds), with narrow pale cinnamon tips to outer rectrices. ♀: similar to ♂ but averaging more bronzy, less coppery. Immature ♀: purplish-copper with narrow pale cinnamon tips to outer rectrices.

Despite average differences, some eastern birds appear indistinguishable from some western birds of corresponding age and sex and thus I consider that the eastern population does not warrant subspecific recognition.

Range. Disjunct. Western population: Guerrero, S and E of the Rio Balsas, and western Oaxaca, at elevations of 730 to 1400 m. Occurs in the Sierra Madre del Sur and adjacent arid valleys from the vicinity of Chilpancingo, Guerrero, E to km 136 on Highway 131, the Puerto Escondido Road, Oaxaca. Apparent range break between these two areas may reflect lack of collecting in this remote area. The westernmost record is San Vicente de Benitez, Guerrero, where I saw one bird in humid forest edge on 21 and 23 May 1990; apparently only

a visitor to this area (pers. obs.). No nesting data. Specimens examined: 9♂♂, 2 immature ♂♂, 4♀♀, 1 immature (sex?). Culmen: 11 ♂♂ (19–22.5, 21.3); 3 ♀♀ (21.4–24.2, 22.8).

Eastern population: Pacific slope foothills of eastern Oaxaca (W to 12 miles NE of Juchitán) and western Chiapas, and interior valley of Chiapas, at elevations of 60–1300 m. The easternmost record is 27 km by road N of Motozintla, Chiapas, where I saw one bird on 4 January 1992. Nesting in at least Apr–Jun. Specimens examined: 16 ♂♂, 5 immature ♂♂, 14♀♀, 1 immature ♀. Culmen: 21 ♂♂ (20.3–23.1; 21.9); 15♀♀ (21.6–24.4; 23.1).

***Amazilia viridifrons rowleyi*, subsp. nov.**

Holotype. WFVZ No. 19600; male (testes 2 × 2 mm) from 13 miles south of Matatlan (=Santiago Matatlán), Oaxaca, Mexico, elevation 4300 feet; collected by J. S. Rowley on 1 April 1968, original field number 5540.

Diagnosis. Appears intermediate between *A. v. viridifrons* and *A. (v?) wagneri* but closer to the former from which it differs in more extensively vinaceous-cinnamon flanks and axillars, duller upperparts, concealed cinnamon bases to secondaries of adult ♂, broader cinnamon tips to outer rectrices of immature, and less sexual dimorphism in culmen length, in these last three features approaching *wagneri*. Readily distinguished from *wagneri* by duller and less extensive cinnamon on flanks and axillars, lack of rufous or dull cinnamon on wings except as concealed patch in adult ♂, and bronzy to purplish-copper tail.

Upperparts. Crown blackish with oily green to bluish-green sheen in ♂; dark green in ♀ and immature ♂. Nape, mantle, and chest sides bronzy green, duller than nominate *viridifrons*, feathers on chest sides narrowly edged pale vinaceous-cinnamon, more distinctly so in ♂♂; lower back to upper tail-coverts dull bronzy to grey-brown.

Underparts. Flanks and axillars: in ♂, mottled to washed vinaceous-cinnamon to dull cinnamon, usually with some bronzy-green spotting, axillars often brighter, vinaceous-cinnamon; immature ♂ brighter, vinaceous-cinnamon to cinnamon with only a few bronzy-green spots; ♀ dusky vinaceous-cinnamon, duller than ♂, spotted bronzy-green; immature ♀ vinaceous-cinnamon, brighter and with, on average, less bronzy-green spotting than ♀. Under tail-coverts usually (but not always) with fairly distinct pale cinnamon spots on basal coverts, rarely with faint pale cinnamon shaft streaks on distal coverts. **Wings**. Concealed cinnamon to pale cinnamon bases of secondaries in adult ♂, no concealed cinnamon in ♀ or immature. Marginal wing-coverts cinnamon, brighter in ♂♂. **Tail**. ♂: burnished copper to purplish-copper with narrow bronzy-green edgings. Immature ♂: typically bronzy basally becoming purplish distally (but one all-bronzy, one all-purplish), with outer rectrices distinctly tipped cinnamon. ♀: burnished copper with bronzy-green edgings (2 birds) to bronzy basally, purplish distally (2 birds). Immature ♀: coppery-purplish becoming bronzy basally, with outer rectrices distinctly tipped cinnamon.

Range. Interior Oaxaca in upper reaches of Rio Grande drainage (specimens from 11 miles S of Santiago Matatlán to Rancho Las Animas which is 2 miles W of Nejapa); also seen 16, 30, and 62 km by road SE of Las Animas in Dec 1991 (pers. obs.). Elevations of 600–1500 m. Nesting at least in Dec–Feb. Specimens examined: 15 ♂♂, 11 immature ♂♂, 4 ♀♀, 3 immature ♀♀; 1 ♂ intergrade between *rowleyi* and *wagneri* (CAS 71888). Culmen: 19 ♂ (21.1–23.9; 22.2); 4 ♀ (22.4–23.6; 22.7).

Etymology. Named for the late J. Stuart Rowley in recognition of his dedicated field studies in Mexico, in particular his work on hummingbirds in the state of Oaxaca.

Amazilia (viridifrons?) wagneri Phillips

Amazilia violiceps wagneri Phillips, 1964, Rev. Soc. Mex. Hist. Nat. 25: 222. 16°01'N, 97°04'30"W (approximately), Oaxaca.

Diagnosis. **Upperparts.** Crown blackish (often with oily blue-green sheen) in ♂, blackish-green in immature ♂, dark green in ♀ and immature ♀. Nape emerald green to bronzy-green, back bronzy-green, rump and upper tail-coverts bronzy, broadly edged cinnamon. **Underparts.** Flanks and axillars: in ♂, bright cinnamon to cinnamon-rufous, this colour extending up into auriculars and along lower edge of lores to bill; immature ♂, cinnamon overall paler and less extensive than ♂; ♀ paler than ♂ (bright vinaceous-cinnamon), less extensive in auriculars and loreal region; immature ♀, cinnamon slightly brighter than ♀, and more extensive on neck and sides. Under tail-coverts usually with well-defined cinnamon spots on basal coverts and, less often, with pale cinnamon shaft streaks on distal coverts. Rarely (2 ♂♂) under tail-coverts clean white (AMNH 815302 from 19 mi. N Puerto Escondido, and LSU 24352 from 18 mi. SE Matatlán). **Wings.** Rufous to dull rufous on both webs of secondaries and on outer webs of inner primaries forms distinct wing panel in ♂; wing panel duller cinnamon and restricted to secondary bases in immature ♂; rufous restricted to tertial tips and inner webs of secondaries (mostly concealed) in ♀, but rarely (1 ♀) extending as dull panel on to inner primaries; dull cinnamon on secondaries concealed in immature ♀. Marginal wing-coverts cinnamon-rufous to cinnamon. **Tail.** ♂: rufous-chestnut, edged bronzy-green. Immature ♂: central rectrices purplish-copper, edged bronzy-green, outer rectrices chestnut-rufous, narrowly edged bronzy-green and tipped cinnamon (tips worn). ♀: central rectrices bronzy to bronzy-gold (purplish-copper in 1 ♀), outer rectrices rufous, narrowly edged bronzy. Immature ♀: central rectrices bronzy, outer rectrices rufous, edged bronzy-green and distinctly tipped cinnamon.

Range. Southern Oaxaca, from Pacific slope foothills of the Sierra de Miahuatlán W to the Isthmus of Tehuantepec (E to 12 miles NE of Juchitán), thence to upper Rio Grande drainage (W to 18 miles S of Santiago Matatlán), at elevations of 250–900 m. Nesting at least in Jan–Feb, May, and Aug–Oct. Specimens examined: 13 ♂♂, 1 immature ♂, 9 ♀♀, 1 immature ♀; 1 sex “?” (♀?) intergrade between *wagneri* and

rowleyi (LSU 24353). Culmen: 14 ♂ (20.1–23.0; 21.3); 9 ♀ (20.5–23.7; 21.7).

Remarks. One specimen (LSU 27433) is labelled ♀ but has the tail pattern and bright wing panel typical of a ♂; this bird may be mislabelled.

Discussion

The distribution of Green-fronted Hummingbirds in southern Mexico presents an interesting problem. Hubbard (1974) discussed the mechanisms of glacial fragmentation and differentiation in the Pleistocene Epoch for several species groups in the arid lands of the southwestern United States and Mexico. I hypothesize that similar mechanisms have caused the present distribution of Green-fronted Hummingbirds in southern Mexico.

The similarity of western and eastern populations of Green-fronted Hummingbird suggests that the ancestor of the species had, at one time, a continuous distribution. Glacial advance may have forced this form into disjunct refugia in the interiors of Guerrero and Chiapas, at the same time isolating on the Pacific slope of Oaxaca a population that became *wagneri*. Glacial retreat then allowed the populations to expand and secondary contact between *wagneri* and *viridifrons* formed a hybrid swarm that led to the subspecies *rowleyi*. A second glacial advance again pushed back *viridifrons* to Guerrero and Chiapas and *wagneri* to the Pacific slope, but allowed *rowleyi* to remain in the upper Río Grande drainage. The situation one sees today reflects a further glacial retreat by which *wagneri* and *rowleyi* have come into secondary contact and *viridifrons* has connected with *rowleyi* through the interior of Oaxaca.

The apparent hiatus in the range of Green-fronted Hummingbirds between western Oaxaca (km 136 on the Puerto Escondido road) and the upper Río Grande drainage is an artifact of incomplete collecting. The one specimen labelled from this area was collected by Mario del Toro Avilés, purportedly at San Pablo Valle de Mitla, but Binford (1989) has shown that Avilés' specimens are notoriously unreliable and has cast doubt on the specimen's data. While Green-fronted Hummingbirds appear to be uncommon in Oaxaca between the ranges of western *viridifrons* and *rowleyi*, there are several records. On 9 January 1987, S. Webb and I found a Green-fronted Hummingbird feeding a recently fledged juvenile at km 82 (i.e. 82 km S of Oaxaca City) on Highway 175 (the Puerto Angel road); and I saw one bird (probably an immature) on 20 December 1991 at km 20 on that same road. At the reservoir 2 km north of Teotitlán del Valle (about 20 km E of Oaxaca City) I have seen single birds (at least two individuals in total) in December of 1989, 1990 and 1991. All of these birds were studied carefully and had a distinct vinaceous to vinaceous-cinnamon wash on their flanks, although apparently less pronounced than on *rowleyi*. Without in-hand examination, however, it was impossible to determine if these birds were *rowleyi* or, as might be expected on geographic grounds, intergrades between *viridifrons* and *rowleyi*.

The more strongly vinaceous-cinnamon flanks and axillars of some birds from km 136 on the Puerto Escondido road probably indicate

intergradation between *viridifrons* and *rowleyi*. This cinnamon colour has been suggested (on specimen labels) to indicate intergradation between *viridifrons* and *wagneri* from the southwestern part of the Pacific slope. The cinnamon colour is typical, however, of *rowleyi*, and the brightest km 136 birds show no other *wagneri* characters. Further, while suitable Green-fronted Hummingbird habitat is continuous from km 136 through the valley of Oaxaca to the range of *rowleyi*, the cloud forest and pine-oak forest of the Sierra de Miahuatlán separate suitable *viridifrons* habitat in the interior from *wagneri* habitat on the Pacific slope.

True *wagneri* may be specifically distinct from *A. viridifrons*. It is a very well-marked form when all characters are considered, in particular wing pattern and tail pattern in combination with the striking cinnamon sides which (unlike *viridifrons* and *rowleyi*) may be brighter in adult ♂♂ than immature ♂♂.

In eastern Oaxaca, *wagneri* and *A. v. viridifrons* appear to be sympatric: both were collected 12 miles NE of Juchitán in July 1957. In the upper Río Grande drainage, *wagneri* and *rowleyi* are sympatric: LSU 24352 (*wagneri*) from 18 miles SE of Matatlán lies amid 1 WFVZ specimen of *rowleyi* 11 miles S of Matatlán, 7 WFVZ *rowleyi* from 13 miles S of Matatlán, 1 WFVZ *rowleyi* from 20 miles S of Matatlán, and 21 MLZ *rowleyi* from Rancho las Animas (about 23 miles SE of Matatlán); 94.6% of specimens from this area are clearly one form or the other. *A. v. viridifrons* does not occur in the upper Río Grande drainage.

Only two specimens, both from the upper Río Grande drainage, appear to be intergrades. CAS 71888, a ♂ from Nejapa, differs from *rowleyi* in the cinnamon of the flanks and axillars being brighter than typical and extending up as small spots and flecks into the lower auriculars and to the base of the bill. LSU 24353 (labelled *wagneri*), of unknown sex (but probably a ♀ by plumage), from 18 miles S of Santiago Matatlán, differs from typical *wagneri* in the dull and reduced cinnamon secondary bases, and in the bronzy-green of the outer rectrices extending on to the inner webs, leaving only a small rufous wedge at the tip of the outer webs.

Finally, specimens of *wagneri* from the Sierra de Miahuatlán and *A. v. viridifrons* 40 km to the north in interior Oaxaca show no unequivocal signs of intergradation (see above).

Further studies should be concentrated at each extreme of the range of *wagneri* to determine the degree of sympatry and interbreeding (if any) with other Green-fronted Hummingbirds. If *wagneri* is considered specifically distinct I suggest the English name Cinnamon-sided Hummingbird.

Summary

An analysis of the *Amazilia viridifrons* complex reveals that one form may warrant specific recognition as *A. wagneri*, Cinnamon-sided Hummingbird. In addition, I describe a distinct subspecies of *A. v. viridifrons* from central Oaxaca. Disjunct western and eastern populations of *viridifrons* appear sufficiently similar that separate subspecific recognition for them is not warranted. Prior to this study, sex and age variation were

poorly understood in *A. viridifrons* and probably obscured taxonomic recognition of the forms involved.

Acknowledgements

In the course of this study I learned that J. Stuart Rowley and Jack von Bloeker of the Western Foundation of Vertebrate Zoology had been working on the problem of *Amazilia viridifrons* and had recognized the subspecific distinctness of the birds I describe here as *rowleyi* (L. F. Kiff pers. comm.). Were it not for the untimely death of Rowley in 1968 (von Bloeker died in 1991), an understanding of the variation in *Amazilia viridifrons* would no doubt have appeared sooner.

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